

GTPCI Fall 2022 Curriculum Retreat and Post-Retreat Summary

Johns Hopkins Mt. Washington Campus

December 14, 2022 - 8:30 am to 1:00 pm

Participants Were:

Data Science	Clinical Trials	Health Services Research	Pathogenesis
Jessica Ruck	Daniel Ford	Jack Iwashyna	Elias Sotirchos
Abimereki Muzaale	Marie Diener-West	Tiffany Mark	Joe Bienvenu
Bill Werbel	Dale Needham	Allan Gelber	Frank Adkinson
Rachel Wallwork	Julie Hoover-Fong	Halima Amjad	Yumeng Wen
Charlie Flexner	Elisa Ignatius	Karen Bandeen-Roche	Mela Bembea
Abdulla Damluji	Sapna Kudchadkar		
Aly Strauss	Betsy King		
Mickey Eagleson	Pete Miller		
	Abin Puravath		

SUMMARY

GTPCI Pathways for MHS and PhD Trainees

Effective August 2023, The GTPCI is introducing four academic pathways for MHS and PhD trainees: Data Science (including machine learning and artificial intelligence), Disease Oriented Studies, Health Services Research, and General Clinical Investigation (including clinical trials).

The field of clinical investigation has expanded since GTPCI started in 1993. The goal of introducing these pathways is to allow trainees more flexibility to choose coursework relevant to their academic interests.

The **General Clinical Investigation** pathway's goal is to teach trainees key principles necessary for the conduct of clinical studies, including development of research questions and appropriate study designs, research protocols, consent statements, monitoring plans, and data collection plans. Trainees who choose the General Clinical Investigation pathway are those interested in a career focusing on clinical trials, or areas of investigation that do not fall within data science, disease-oriented studies, and health services research.

Trainees who choose the **Disease-Oriented Studies** pathway are those interested in linking a basic pathophysiological mechanism, with a risk for disease, or the development of an intervention targeting that disease. Such research is sometimes referred to as 'translational research'.

Data science combines medical domain expertise with math and statistics, specialized programming, advanced analytics, and in some cases, artificial intelligence (AI), and machine learning to uncover actionable insights in biomedicine. Trainees who choose the Data Science pathway will create a learning plan to achieve the required skills necessary to interrogate large databases and uncover insights from big data.

Health Services Research is the field of scientific investigation that examines how social factors, organizational structures and processes, financing systems, technologies, and behaviors affect multiple facets of health and healthcare. The goals of the Health Services Research pathway are to guide trainees in formulating an approach that is nested within economic or sociological theory, to answer research questions using a contemporary approach to causal inference, and to teach trainees skills in the analysis of cost, utilization, and value.

Applicants may designate a specific pathway in their initial GTPCI application or may consult members of the GTPCI academic committee after acceptance into the GTPCI program for guidance in choosing an appropriate pathway that is congruent with their academic pursuits.

FOUNDATIONAL COURSES

Trainees in all 4 pathways must take the following “*foundational courses*” (a total of 51 credits).

1st Term September-October 17 Credits			
340.751.41 340.951	5	Epidemiologic Methods I Epi Labs	M W F 9:00-11:50 Hybrid: lectures and labs - on-campus and synchronous online
140.621.81 140.921	4	Statistical Methods in Public Health I Biostat Labs	Online asynchronous lectures Options for synchronous labs Live Talks every Tues 7-8:30 pm
550.600.41	1	Living Science Ethics/Responsible Conduct Research	W 4:00-5:00 Hybrid: synchronous via Zoom and online asynchronous lectures
550.860.82	0	Academic Research Ethics	Online asynchronous
390.631.01	2	Principles of Drug Development	W 1:30-2:50 On-campus
390.751.71	2	Seminars in Clinical Investigation I	M 1:30-2:50 Synchronous via Zoom
390.673.01**	3	Ethical & Regulatory Issues in Clinical Research	M 5:30-8:30 On-campus
2nd Term October-December 13 Credits			
340.752.41 340.952	5	Epidemiologic Methods II Epi Labs	M W F 9:00-11:50 Hybrid: lectures and labs - on-campus and synchronous online
140.622.81 140.922	4	Statistical Methods in Public Health II Biostat Lab	Online asynchronous lectures Options for synchronous labs Live Talks every Tues 7-8:30 pm
390.752.71	2	Seminars in Clinical Investigation II	W 1:30-2:50 Synchronous via Zoom
390.710.60 OR .62	2	Biomedical Writing I (2 sections .60 & .62 – choose best time for you)	Th 8:30-10:20 OR T 3:30-5:20 Hybrid: 6 synchronous sessions via Zoom/2 on-campus sessions
3rd Term January-March 11 Credits			
340.753.01 340.953	5	Epidemiologic Methods III Epi Labs	M W F 9:00-11:50 Hybrid: lectures and labs - on-campus and synchronous online
140.623.81 140.923	4	Statistical Methods in Public Health III Biostat Labs	Online asynchronous lectures Options for synchronous labs
390.721.71	2	Grant Writing and Presentation Skills I	Th 8:30-10:20 Synchronous via Zoom
4th Term March-May 10 Credits			
140.624.41	4	Statistical Methods in Public Health IV	Online asynchronous lectures Options for synchronous labs
390.722.71	4	Grant Writing and Presentation Skills II	M 1:30-5:20 Synchronous via Zoom
390.711.60 OR .62	2	Biomedical Writing II (2 sections .60 & .62 – choose best time for you)	T 1:30-3:20 OR W 10:00-11:50 Hybrid: 6 synchronous sessions via Zoom/2 on-campus sessions

The remaining credits necessary to complete the MHS degree (a total of 70 credits) and the PhD degree (registration for at least 16 credits for 4 consecutive terms then 5 additional courses in years 2/3) will be obtained from the required and elective courses within each pathway as summarized below.

General Clinical Investigation Pathway

Description

The **General Clinical Investigation** pathway's goal is to teach trainees key principles necessary for the conduct of clinical studies, including development of research questions and appropriate study designs, research protocols, consent statements, monitoring plans, and data collection plans. Trainees who choose the **General Clinical Investigation** pathway are those interested in a career focusing on clinical trials, or areas of investigation that do not fall within data science, disease-oriented studies, and health services research.

Pathway-Specific Competencies

MHS

- Identify key principles for the development of protocols, consent statements, monitoring plan, and data collection plan for clinical trials

PhD

- Develop research questions, design studies, and create protocols that ensure the safety of study participants and the accuracy and reliability of data.
- Collect, manage, and analyze research data using appropriate methods and tools, ensuring the accuracy and completeness of the data, and maintaining data privacy and confidentiality

Pathway-Specific Courses

Required MHS Courses:

We strongly recommend the following courses:

340.645 Introduction to Clinical Trials (3 credits)

340.694 Power & Sample Size for the Design of Epidemiological Studies (1 credit)

340.861 Clinical Trials: Procedures, Design, and Interpretation of Results (3 credits)

Required PhD Courses:

340.645 Introduction to Clinical Trials (3 credits)

340.694 Power & Sample Size for the Design of Epidemiological Studies (1 credit)

340.861 Clinical Trials: Procedures, Design, and Interpretation of Results (3 credits)

140.642 Design of Clinical Experiments (3 credits)

340.606 Methods for Conducting Systematic Reviews and Meta-analyses (3 credits)

Strongly Recommended: **340.648** Clinical Trials Management (3 credits)

Strongly Recommended: **340.633** Data Management in Clinical Trials (3 credits)

Strongly Recommended: **340.660** Practical Skills in Conducting Research in Clinical Epidemiology and Investigation (3 credits)

Electives

140.655 Analysis of Longitudinal Data (3 credits)

140.641 Survival Analysis (3 credits)

340.706 Methods and Applications of Cohort Studies (2 credits)
340.728 Advanced Methods for Design and Analysis of Cohort Studies (5 credits)
140.642 Design of Clinical Experiments (3 credits)
340.606 Methods for Conducting Systematic Reviews and Meta-analyses (3 credits)
340.648 Clinical Trials Management (4th term)
340.633 Data Management in Clinical Trials (3 credits)
340.660 Practical Skills in Conducting Research in Clinical Epidemiology and Investigation (3 credits)
140.664 Causal Inference in Medicine and Public Health (3 credits)
223.664 Design and Conduct of Community Trials (4 credits)
223.690 The Design and Analysis of Cluster Randomized Trials (2 credits)
223.705 Good Clinical Practice: A Vaccine Trials Perspective (4 credits)
340.671 Topics in Management of Clinical Trials (2 credits)
340.676 Bayesian Adaptive Trials (2 credits)
223.662 Vaccine Development and Application (4 credits)
140.633 Biostatistics in Medical Product Regulation (2 credits)
340.682 Pharmacoepidemiology Methods (3 credits)
340.684 Pharmacoepidemiology: Drug Utilization (3 credits)
340.619 Topics in Pharmacoepidemiology (2 credits)
390.631 Principles of Drug Development (2 credits)

Courses offered outside of BSPH: Students must obtain written permission from instructors

AS.410.649 Introduction to Regulatory Affairs (4 credits)

AS.410.676 Food and Drug Law (3 credits)

Additional Suggestions

The Seminars in Clinical Investigations should include 1-2 session that are pathway specific in which students do different things based on their pathway. Clinical trials specific seminars could focus on role/ responsibility of DSMB, budget development for clinical trials, FDA site visit, sit-in on FDA/IND panel meetings.

The Clinical Trials pathway PhD students would be eligible to apply for apprenticeship within the NIH Clinical Trials program which would be a more intensive year-long experience.

Disease-Oriented Studies Pathway (Translational Disease-Specific Pathway)

Description

Trainees who choose the **Disease-Oriented Studies** pathway are those interested in linking a basic pathophysiological mechanism, with a risk for disease, or the development of an intervention targeting that disease. This pathway may also be referred to as the 'Translational Disease-Specific Pathway'.

Pathway-Specific Competencies

MHS

Demonstrate understanding of the stages of translational research, from discovery to implementation

PhD

Design research studies that are relevant to your disease of interest and have potential impact on patient outcomes

Collaborate effectively with interdisciplinary teams, including basic scientists, clinicians, and/or industry partners

Pathway-Specific Courses

MHS

None

PhD

None

Electives

340.731 Principles of Genetic Epidemiology 1 (4 credits)

340.732 Principles of Genetic Epidemiology 2 (3 credits)

340.733 Principles of Genetic Epidemiology 3 (3 credits)

340.734 Principles of Genetic Epi 4: Emerging and Advanced Methods (2 credits)

187.633 Introduction to Environmental Genomics and Epigenomics (3 credits)

140.688 Statistics for Genomics (3 credits)

140.630 Introduction to Data Management (3 credits)

140.656 Multilevel Statistical Models in Public Health (4 credits)

140.655 Analysis of Longitudinal Data (4 credits)

140.641 Survival Analysis (3 credits)

340.706 Methods and Applications of Cohort Studies (2 credits)

340.728 Advanced Methods for Design and Analysis of Cohort Studies (5 credits)

340.606 Methods for Conducting Systematic Reviews and Meta-Analyses (4 credits)

140.664 Causal Inference in Medicine and Public Health I (4 credits)

140.665 Causal Inference in Medicine and Public Health II (3 credits)

140.711 Advanced Data Science I (3 credits)

140.712 Advanced Data Science II (3 credits)

140.642 Design of Clinical Experiments (3 credits)

340.645 Introduction to Clinical Trials (3 credits)

340.694 Power & Sample Size for the Design of Epidemiological Studies (1 credit)

340.861 Clinical Trials: Procedures, Design, and Interpretation of Results (3 credits)

140.642 Design of Clinical Experiments (3 credits)

340.606 Methods for Conducting Systematic Reviews and Meta-analyses (3 credits)

340.648 Clinical Trials Management (3 credits)

340.633 Data Management in Clinical Trials (3 credits)

340.660 Practical Skills in Conducting Research in Clinical Epidemiology and Investigation (3 credits)
223.662 Vaccine Development and Application (4 credits)
140.633 Biostatistics in Medical Product Regulation (2 credits)
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340.684 Pharmacoepidemiology: Drug Utilization (3 credits)
340.619 Topics in Pharmacoepidemiology (2 credits)
390.631 Principles of Drug Development (2 credits)

Data Science Pathway

Description

Data science combines medical domain expertise with math and statistics, specialized programming, advanced analytics, and in some cases, artificial intelligence (AI), and machine learning to uncover actionable insights in biomedicine. Trainees who choose the Data Science pathway will create a learning plan to achieve the required skills necessary to interrogate large databases and uncover insights from big data.

Pathway-Specific Competencies

MHS

- Describe rigorous, responsible, and reproducible data use management techniques
- Formulate analytical plans for big data

PhD

- Develop a protocol for data management and storage that ensures compliance with regulatory requirements and promotes transparency and reproducibility
- Formulate analytical plans for big data
- Analyze various data types (e.g., omics, EHR, imaging) and/or large datasets

Pathway-Specific Courses

Required Courses for MHS

None

Required Courses for PhD

None

Suggested Electives

140.655 Analysis of Longitudinal Data (4 credits)
140.641 Survival Analysis (3 credits)
340.706 Methods and Applications of Cohort Studies (2 credits)
340.728 Advanced Methods for Design and Analysis of Cohort Studies (5 credits)
340.606 Methods for Conducting Systematic Reviews and Meta-Analyses (4 credits)

340.696 Spatial Analysis I: ArcGIS (3 credits)
140.628 Data Science for Public Health I (4 credits)
140.629 Data Science for Public Health II (4 credits)
140.644 Statistical Machine Learning: Methods, Theory, and Applications (4 credits)
140.664 Causal Inference in Medicine and Public Health I (4 credits)
140.665 Causal Inference in Medicine and Public Health II (3 credits)
140.644 Statistical Machine Learning: Methods, Theory, and Applications (4 credits)
140.646 Essentials of Probability and Statistical Inference I: Probability (4 credits)
140.647 Essentials of Probability and Statistical Inference II: Statistical Inference (4 credits)
140.648 Essentials of Probability and Statistical Inference III: Theory of Modern Statistical Methods (4 credits)
140.649 Essentials of Probability and Statistical Inference IV (4 credits)
140.776 Statistical Computing (3 credits)
140.711 Advanced Data Science I (3 credits)
140.712 Advanced Data Science II (3 credits)
390.631 Principles of Drug Development (2 credits)

The following electives are outside of BSPH. Please contact the instructors to get permission to register:

EN.520.412 Machine Learning for Signal Processing (3 credits)
EN.520.447 Introduction to Information Theory and Coding (3 credits)
EN.601.475/675 Machine Learning (3 credits)
EN.601.464/664 Artificial Intelligence (3 credits)
EN.605.649 Introduction to Machine Learning (3 credits)
EN.705.601 Applied Machine Learning (3 credits)
EN.605.746 Advanced Machine Learning (3 credits)
EN.580.491 Learning, Estimation and Control (3 credits)
AS.050.372/672 Foundations of Neural Network Theory (3 credits)
AS.050.371/671 Bayesian Inference (3 credits)

Health Services Research Pathway

Description

Health Services Research is the field of scientific investigation that examines how social factors, organizational structures and processes, financing systems, technologies, and behaviors affect multiple facets of health and healthcare. The goals of the Health Services Research pathway are to guide trainees in formulating an approach that is nested within economic or sociological theory, to answer research questions using a contemporary approach to causal inference, and to teach trainees skills in the analysis of cost, utilization, and value.

Pathway-Specific Competencies

MHS

- Formulate an HSR approach that is nested within economic or sociological theory
- Understand principles related to the analysis of cost, utilization, and/or value

PhD

- Formulate an HSR approach that is nested within economic or sociological theory
- Develop research questions using a contemporary approach to causal inference
- Acquire skills in the analysis of cost, utilization and/or value

Pathway-Specific Courses

MHS

We recommend the following courses (but they are not required)

309.716 Advanced Methods in Health Services Research: Analysis (3 credits)

221.644 Econometric Methods for Evaluation of Health Programs (4 credits)

140.664 Causal Inference in Medicine and Public Health I (4 credits)

140.665 Causal Inference in Medicine and Public Health II (3 credits)

309.720 Applied Econometrics for Health Policy Research (3 credits)

Required PhD Courses

309.716 Advanced Methods in Health Services Research: Analysis (3 credits)

221.644 Econometric Methods for Evaluation of Health Programs (4 credits)

140.664 Causal Inference in Medicine and Public Health I (4 credits)

140.665 Causal Inference in Medicine and Public Health II (3 credits)

309.720 Applied Econometrics for Health Policy Research (3 credits)

301.615 Seminar in Health Disparities (3 credits)

Electives

309.716 Advanced Methods in Health Services Research: Analysis (3 credits)

221.644 Econometric Methods for Evaluation of Health Programs (4 credits)

140.664 Causal Inference in Medicine and Public Health I (4 credits)

140.665 Causal Inference in Medicine and Public Health II (3 credits)

309.720 Applied Econometrics for Health Policy Research (3 credits)

301.615 Seminar in Health Disparities (3 credits)

300.721 Foundations in Health Policy I (2 credits)

300.722 Foundations in Health Policy II (2 credits)

300.723 Foundations in Health Policy III (2 credits)

340.606 Methods for Conducting Systematic Reviews and Meta-analyses (3rd term)

313.643 Health Economics (3 credits)

313.644 Intermediate Health Economics (3 credits)

410.710 Concepts in Qualitative Research for Social and Behavioral Sciences (3 credits)

317.605 Methods in Quantitative Risk Assessment (4 credits)

309.600 Evaluating Quality Improvement and Patient Safety Programs (3 credits)

309.730 Patient Safety and Medical Errors (3 credits)

300.600 Introduction to Health Policy (4 credits)

300.651 Introduction to the U.S. Healthcare System (4 credits)
300.721 Foundations in Health Policy I (2 credits)
311.615 Quality of Medical Care (3 credits)
140.656 Multilevel Statistical Models in Public Health (4 credits)
380.712 Methods in Analysis of Large Population Surveys (3 credits)
410.612 Sociological Perspectives on Health (3 credits)
140.655 Analysis of Longitudinal Data (4 credits)
340.606 Methods for Conducting Systematic Reviews and Meta-Analyses (4 credits)
390.631 Principles of Drug Development (2 credits)

These electives are outside of BSPH. Please contact the instructors for approval

BU.920.606: Operation Management

BU.920.607: Competitive Strategy

BU.920.634: Behavioral Science: Leading Change

APPENDIX

Prerequisites for the pathway-specific courses

Course #	Course Title	Term	Credits	Prerequisite Course
PH.140.776	Statistical Computing	1	3	140.621 Statistical Methods in Public Health I
PH.140.646	Essentials of Probability and Statistical Inference I	1	4	
PH.140.647	Essentials of Probability and Statistical Inference II	2	4	140.646
PH.140.648	Essentials of Probability and Statistical Inference III	3	4	140.646-647
PH.140.649	Essentials of Probability and Statistical Inference IV	4	4	140.646-648
PH.140.644	Statistical Machine Learning: Methods, Theory, and Applications	3	4	
PH.140.628	Data Science for Public Health I	3	4	
PH.140.629	Data Science for Public Health II	4	4	140.628
PH.140.664	Causal Inference	3 & 4	4	140.621-624 or 140.651-654
		Semester	Credits	
EN.520.412	Machine Learning for Signal Processing	Fall	3	AS.110.201 Linear Algebra and EN.550.310 Probability & Statistics for the Physical Sciences & Engineering and EN.520.435 Introduction to Digital Signal Processing
EN.520.447	Introduction to Information Theory and Coding	Fall	3	EN.553.310 Probability & Statistics for the Physical Sciences & Engineering, or EN.553.420

				Probability, or EN.553.311 Intermediate Probability and Statistics
AS.050.371/671	Bayesian Inference	Fall	3	
EN.601.475/675	Machine Learning	Fall & Spring	3	
EN.601.464/664	Artificial Intelligence	Fall & Spring	3	EN.605.202 Data Structures
EN.605.649	Introduction to Machine Learning	Fall & Spring	3	EN.605.202 Data Structures
EN.705.601	Applied Machine Learning	Fall & Spring	3	EN.705.621 Introduction to Algorithms, or EN.605.621 Foundations of Algorithms, or EN.685.621 Algorithms for Data Science
EN.605.746	Advanced Machine Learning	Spring	3	EN.605.649 Introduction to Machine Learning
AS.050.372/672	Foundations of Neural Network Theory	Spring	3	AS.110.201 Linear Algebra
EN.580.491	Learning, Estimation and Control	Spring	3	AS.110.201 Linear Algebra and AS.110.302 Differential Equations with Applications